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Amendment filed October 20, 2005
Reply to Office Action of June 2, 2005

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AMENDMENTS TO THE CLAIMS

What is claimed is:

1. (Currently amended) A digital TV receiver, comprising:

an A/D converter for converting an analog passband signal into a digital passband signal;

a carrier recovery for converting the digital passband signal into a digital baseband signal; and

a symbol clock recovery for detecting timing error information by calculating digital-real/imaginary-passband-signals of the A/D converter or digital-real/imaginary-baseband-signals of a the carrier recovery and squaring the added valuecalculated result, and for generating and outputting two times the frequency of athe symbol clock corrected from the detected timing error information.

2. (Currently amended) The digital TV receiver of claim 1 further comprising a fixed oscillator for oscillating at a fixed frequency, wherein the A/D converter converts the analog passband signal into the digitala passband signal by sampling the analog signal at thea fixed frequency generated by the fixed oscillator or by sampling the analog passband signal with two times the frequency of the symbol clock.

3. (Original) The digital TV receiver of claim 2, wherein the fixed frequency generated from the fixed oscillator is higher than the two times the frequency of the symbol clock.

4. (Original) The digital TV receiver of claim 1, wherein the carrier recovery multiplies a standard carrier signal by the digital passband signal through the carrier recovery and converts into the digital baseband signal.

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5. (Currently amended) The digital TV receiver of claim 1 further ~~comprises~~ comprising a first resampler for resampling the digital real/imaginary baseband signals into the two times frequency of the symbol clock frequency and interpolating each of the signals.

6. (Currently amended) The digital TV receiver of claim 5, wherein the symbol clock recovery comprises:

an operator for calculating each of the digital ~~baseband~~ real/imaginary baseband signals interpolated and outputted from the first resampler, and outputting the calculation;

a squarer for squaring the output value of the operator;

a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a filtering unit for filtering only the low passband signal from the timing error information outputted from the timing error detector; and

a NCO for generating two times the frequency of the symbol clock recovered according to low pass signals of the filtered timing error information and outputting to the first resampler.

7. (Currently amended) The digital TV receiver of claim 6, wherein the operator squares each of the digital baseband real/imaginary signals interpolated and outputted from the first resampler, adds the two squared signals, and outputs the ~~calculation~~ calculated result; or calculates an absolute value for each of the digital baseband real number/imaginary signals interpolated and outputted from the first resampler, adds the absolute value of the two signals, and outputs the calculation.

8. (Currently amended) The digital TV receiver of claim 5, wherein the symbol clock recovery ~~comprising~~ comprises:

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a second resampler for resampling the digital passband real/imaginary signals outputted from the A/D converter into the two times frequency of the symbol clock frequency and interpolating each of the signals;

a̲n̲ operator for calculating the digital passband real/imaginary signals outputted from the second resampler and outputting the calculation;

a squarer for squaring the output value of the operator;

a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a̲ ̲f̲i̲l̲t̲e̲r̲i̲n̲g̲ ̲u̲n̲i̲t̲ ̲f̲o̲r̲ ̲f̲i̲l̲t̲e̲r̲i̲n̲g̲ ̲o̲n̲l̲y̲ ̲t̲h̲e̲ ̲l̲o̲w̲ ̲p̲a̲s̲s̲b̲a̲n̲d̲ ̲s̲i̲g̲n̲a̲l̲ ̲f̲r̲o̲m̲ ̲t̲h̲e̲ ̲t̲i̲m̲i̲n̲g̲ ̲e̲r̲r̲o̲r̲ ̲i̲n̲f̲o̲r̲m̲a̲t̲i̲o̲n̲ ̲o̲u̲t̲p̲u̲t̲t̲e̲d̲ ̲f̲r̲o̲m̲ ̲t̲h̲e̲ ̲t̲i̲m̲i̲n̲g̲ ̲e̲r̲r̲o̲r̲ ̲d̲e̲t̲e̲c̲t̲o̲r̲;̲ ̲a̲n̲d̲

a NCO for generating two times the frequency of the symbol clock recovered according to low pass signal component of the filtered timing error information and outputting to the first and the second resamplers.

9. (Currently amended) The digital TV receiver of claim 8, wherein the operator squares each of the digital b̶a̶s̶e̶p̲a̲s̲s̲band real/imaginary component signals interpolated and outputted from the second resampler, adds the two squared signals, and outputs the c̶a̶l̶c̶u̶l̶a̶t̶i̶o̶n̶ c̲a̲l̲c̲u̲l̲a̲t̲e̲d̲ r̲e̲s̲u̲l̲t̲; or calculate̲s̲ an absolute value for each of the digital b̶a̶s̶e̶p̲a̲s̲s̲band real/imaginary component signals interpolated and outputted from the second resampler, adds the absolute value of the two signals, and outputs the calculation.

10. (Currently amended) The digital TV receiver of claim 1, wherein the symbol clock recovery comprises:

an operator for calculating each of the digital baseband real/imaginary signals i̶n̶t̶e̶r̶p̶o̶l̶a̶t̶e̶d̶ ̶a̶n̶d̶ outputted from the c̲a̲r̲r̲i̲e̲r̲ ̲r̲e̲c̲o̲v̲e̲r̲y̶f̶i̶r̶s̶t̶ ̶r̶e̶s̶a̶m̶p̶l̶e̶r̶, and outputting the calculation;

a squarer for squaring the output value of the operator;

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a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a filtering unit for filtering only the low passband signal from the timing error information outputted from the timing error detector; and

a variable oscillator for generating two times the frequency of the symbol clock recovered according to low pass signal component of the filtered timing error information and outputting to the A/D converter.

11. (Currently amended) The digital TV receiver of claim 10, wherein the operator squares each of the digital baseband real/imaginary signals ~~interpolated and~~ outputted from the carrier recovery, adds the two squared signals, and outputs the calculation; or calculates an absolute value for each of the digital baseband real/imaginary component signals ~~interpolated and~~ outputted from the carrier recovery, adds the absolute value of the two signals, and outputs the calculation.

12. (Currently amended) The digital TV receiver of claim 1~~0~~, wherein the symbol clock recovery comprises:

an operator for calculating each of the digital ~~base~~passband real/imaginary signals ~~interpolated and~~ outputted from the A/D converter, and outputting the calculation;

a squarer for squaring the output value of the operator;

a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a filtering unit for filtering only the low passband signal from the timing error information outputted from the timing error detector; and

a variable oscillator for generating two times the frequency of the symbol clock recovered according to low pass signals of the filtered timing error information and outputting to the A/D converter.

13. (Currently amended) The digital TV receiver of claim 1~~2~~20, wherein the operator squares each of the digital ~~base~~passband real/imaginary component signals ~~interpolated and~~ outputted from the A/D converter, adds the two squared signals, and outputs the calculation; or calculate_s_ an absolute value for each of the digital ~~base~~passband real/imaginary component signals ~~interpolated and~~ outputted from the A/D converter, adds the absolute value of the two signals, and outputs the calculation.

14. (Currently amended) A digital TV receiver, comprising:

an A/D converter for taking a sample of a fixed frequency from an analog passband signal and converting into a digital passband signal;

a carrier recovery for multiplying a standard carrier signal generated from the process of the carrier recovery of the digital passband signal and converting into the digital baseband signal;

a first resampler for taking a sample of two times the frequency of the symbol clock from the digital baseband real/imaginary signals generated from the carrier recovery and interpolating[[.]]; and

a symbol clock recovery for detecting timing error information by calculating ~~from~~ the digital passband signal or the digital baseband signal and squaring the calculating result, and for generating and outputting the two times frequency of the symbol clock frequency corrected from the detected timing error information.

15. (Currently amended) The digital TV receiver of claim 14, wherein the symbol clock recovery comprises:

a_n_ operator for calculating the digital baseband real/imaginary signals interpolated and outputted from the first resampler;

a squarer for squaring the output value of the operator;

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a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a filtering unit for filtering only the low passband signals from the timing error information outputted from the timing error detector; and

a NCO for generating two times the frequency of the symbol clock recovered according to low pass signals of the filtered timing error information and outputting to the first resampler.

16. (Currently Amended) The digital TV receiver of claim 15, wherein the operator squares each of the digital baseband real/imaginary signals interpolated and outputted from the first resampler, adds the two squared signals, and outputs the calculation; or calculates an absolute value for each of the digital baseband real/imaginary signals interpolated and outputted from the first resampler, adds the absolute value of the two signals, and outputs the calculation.

17. (Currently amended) The digital TV receiver of claim 14, wherein the symbol clock recovery comprising:

a second resampler for resampling the digital passband real/imaginary signals outputted from the A/D converter into the two times frequency of the symbol clock frequency and interpolating each of the signals;

an operator for calculating the digital passband real/imaginary signals outputted from the second resampler and outputting the calculation;

a squarer for squaring the output value of the operator;

a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a filtering unit for filtering only the low passband signal from the timing error information outputted from the timing error dector; and

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a NCO for generating two times the frequency of the symbol clock recovered according to low pass signal component of the filtered timing error information and outputting to the first resampler and the second resampler.

18. (Currently amended) The digital TV receiver of claim 17, wherein the operator squares each of the digital ~~base~~passband real/imaginary signals interpolated and outputted from the second resampler, adds the two squared signals, and outputs the calculation; or calculates an absolute value for each of the digital ~~base~~passband real/imaginary signals interpolated and outputted from the second resampler, adds the absolute value of the two signals, and outputs the calculation.

19. (Currently amended) A digital TV receiver, comprising:

an A/D converter for ~~taking a sample of a fixed~~ sampling an analog passband signal with two times the frequency of a symbol clock ~~from an analog passband signal and~~ for -converting the analog passband signal into a digital passband signal;

a carrier recovery for multiplying a standard carrier signal generated from the process of the carrier recovery ~~of~~by the digital passband signal and converting into the digital baseband signal; and

a symbol clock recovery for detecting timing error information ~~from~~ by calculating the digital passband signal or the digital baseband signal and squaring the calculated result, and for generating and outputting the two times frequency of the symbol clock frequency corrected from the detected timing error information.

20. (Currently amended) The digital TV receiver of claim 19, wherein the symbol clock recovery comprises:

an operator for calculating each of the digital baseband real/imaginary signals outputted from the carrier recovery, and outputting the calculation;

a squarer for squaring the output value of the operator;

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a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a filtering unit for filtering only the low passband signal from the timing error information outputted from the timing error detector; and

a variable oscillator for generating two times the frequency of the symbol clock recovered according to low pass signal component of the filtered timing error information and outputting to the A/D converter.

21. (Currently amended) The digital TV receiver of claim 20, wherein the operator squares each of the digital baseband real/imaginary signals interpolated and outputted from the carrier recovery, adds the two squared signals, and outputs the calculation; or calculates an absolute value for each of the digital baseband real/imaginary signals interpolated and outputted from the carrier recovery, adds the absolute value of the two signals, and outputs the calculation.

22. (Currently amended) The digital TV receiver of claim 19, wherein the symbol clock recovery comprises:

an operator for calculating each of the digital basepassband real/imaginary signals interpolated and outputted from the first resamplerA/D converter, and outputting the calculation;

a squarer for squaring the output value of the operator;

a pre-filter for passing only a frequency of a particular band to recover the symbol clock from the output of the squarer;

a timing error detector for detecting timing error information from the output of the pre-filter;

a filtering unit for filtering only the low passband signal from the timing error information outputted from the timing error detector; and

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a variable oscillator for generating two times the frequency of the symbol clock recovered according to low pass signal component of the filtered timing error information, and outputting to the A/D converter.

23. (Currently amended) The digital TV receiver of claim 22, wherein the operator squares each of the digital ~~base~~passband real/imaginary signals outputted from the A/D converter, adds the two squared signals, and outputs the calculation; or calculates an absolute value for each of the digital ~~base~~passband real/imaginary signals outputted from the A/D converter, adds the absolute value of the two signals, and outputs the calculation.